

memory system **500** may be embodied in a personal computer (PC), a tablet PC, or a mobile computing device.

[0170] The memory system **500** includes a main board **540**, a slot **520** mounted on the main board **540**, a memory module **510** which may be inserted to the slot **520**, a chipset **530** which may control an operation of a plurality of memory devices **100-1** to **100-m** mounted on the memory module **510** through the slot **520**, a processor **550** which may communicate with the plurality of memory devices **100-1** to **100-m**. Each of the plurality of memory devices **100-1** to **100-m** may be the memory device **100** illustrated in FIG. 1.

[0171] For convenience of description in FIG. 24, there is illustrated only one memory module **510**; however, the memory system **500** includes at least one or more memory module.

[0172] The chipset **530** is used to transmit or receive data, an address, or control signals between the processor **550** and the memory module **510**. The chipset **530** includes a memory controller **535** for controlling the plurality of memory devices **100-1** to **100-m**.

[0173] FIG. 25 is a block diagram according to another example embodiment of the memory system including the memory device illustrated in FIG. 1. Referring to FIGS. 1 and 25, a system **600** may be embodied in an electronic device or a portable device. The portable device may be embodied in a cellular phone, a smart phone, or a tablet PC.

[0174] The system **600** includes a processor **611** and a memory device **613**. The memory device **613** may be the memory device of FIG. 1. According to an example embodiment, the processor **611** and the memory device **613** may be packaged in a package **610**. In this case, the package **610** may be mounted on a system board (not shown). The package **610** may denote the package **300** illustrated in FIG. 20, or the package **300'** illustrated in FIG. 21.

[0175] The processor **611** includes a memory controller **615** which may control a data processing operation of the memory device **613** (e.g., a write operation or a read operation). The memory controller **615** may be controlled by the processor **611** entirely controlling an operation of the system **600**. According to an example embodiment, the memory controller **615** may be connected between the processor **611** and the memory device **613**.

[0176] Data stored in the memory device **613** may be displayed through a display **620** according to a control signal and/or command of the processor **611**.

[0177] A radio transceiver **630** may transmit or receive a radio signal through an antenna ANT. For example, the radio transceiver **630** may convert a radio signal received through the antenna ANT into a signal which the processor **611** may process. Accordingly, the processor **611** may process a signal output from the radio transceiver **630**, store the processed signal in the memory device **613** or display the processed signal through the display **620**.

[0178] The radio transceiver **630** may convert a signal output from the processor **611** into a radio signal, and output the converted radio signal to outside through the antenna ANT.

[0179] An input device **640**, as a device which may input a control signal for controlling an operation of the processor **611** or data to be processed by the processor **611**, may be embodied in a pointing device such as a touch pad and a computer mouse, a keypad, or a keyboard.

[0180] The processor **611** may control the display **620** so that data output from the memory device **613**, a radio signal

output from the radio transceiver **630**, or data output from the input device **640** may be displayed through the display **620**.

[0181] FIG. 26 is a block diagram according to still another example embodiment of the memory system including the memory device illustrated in FIG. 1. Referring to FIGS. 1 and 26, a system **700** may be embodied in a personal computer (PC), a tablet PC, a net-book, an e-reader, a personal digital assistant (PDA), a portable multimedia player (PMP), a MP3 player, or a MP4 player.

[0182] The system **700** includes a processor **711** for entirely controlling an operation of the system **700** and a memory device **713**. The memory device **713** may denote the memory device **100** illustrated in FIG. 1. According to an example embodiment, the processor **711** and the memory device **713** may be packaged in a package **710**. The package **710** may be mounted on a system board (not shown). The package **710** may denote the package **300** illustrated in FIG. 20 or the package **300'** illustrated in FIG. 21.

[0183] The processor **711** may include a memory controller **715** controlling an operation of the memory device **713**. The processor **711** may display data stored in the memory device **713** through the display **730** according to an input signal generated by the input device **720**. For example, the input device **720** may be embodied in a pointing device such as a touch pad or a computer mouse, a keypad, or a keyboard.

[0184] FIG. 27 is a block diagram according to still another example embodiment of the memory system including the memory device illustrated in FIG. 1. Referring to FIGS. 1 and 27, a system **800** may be embodied in a digital camera or a portable device attached to the digital camera.

[0185] The system **800** includes a processor **811** entirely controlling an operation of the system **800** and a memory device **813**. Here, the memory device **813** may denote the memory device **100** of FIG. 1. The processor **811** may include a memory controller **815** controlling an operation of the memory device **813**.

[0186] According to an example embodiment, the processor **811** and the memory device **813** may be packaged in a package **810**. The package **810** may be mounted on a system board (not shown). The package **810** may denote the package **300** illustrated in FIG. 20 or the package **300'** illustrated in FIG. 21.

[0187] An image sensor **820** of the system **800** converts an optical image into a digital signal, and the converted digital signal is stored in the memory device **813** under a control of the processor **811** or displayed through the display **830**. In addition, the digital signal stored in the memory device **813** is displayed through the display **830** under a control of the processor **811**.

[0188] FIG. 28 is a block diagram according to still another example embodiment of the memory system including the memory device illustrated in FIG. 1. A channel **901** may denote optical connection means. The optical connection means may denote an optical fiber, an optical waveguide, or a medium transmitting an optical signal.

[0189] Referring to FIGS. 1 and 28, a system **900** may include a first system **1000** and a second system **1100**. The first system **1000** may include a first memory device **100a** and an electric-photo conversion circuit **1010**. The electric-photo conversion circuit **1010** may convert an electrical signal output from the first memory device **100a** into a photo